Remarks

The Examiner has objected to the drawings under 37 C.F.R. 1.83(a) on the ground that they fail to show certain claim elements. The Examiner has rejected the pending claims under 35 U.S.C. 112 on the ground that certain claim elements are not properly described in the specification (paragraph 1 of 112) and on the ground that the specification fails to provide a proper antecedent basis for them (paragraph 2 of 112). The Examiner has suggested that applicant provide a clear definition of "other capacitance" and related concepts and that this should be illustrated by drawings.

Applicant has amended the specification to provide an explicit definition for the phrase "other capacitances" using only concepts that were articulated in the original application. Applicant has also amended Claim 58 to remove the reference to the phrase "second voltage regulator" to which the Examiner had objected.

As amended, Applicant respectfully submits that the drawings do show all features of the amended patent claims that are essential for a proper understand of the invention. Applicant also respectfully submits that the remaining quoted claim elements are both enabled and supported by an antecedent basis in the specification. Reconsideration and allowance of the pending claims is therefore requested.

Technology Overview

The invention may be used in connection with liquid crystal ("LC") displays.

As is well known, and as illustrated in Fig. 1, an LC display may have a plurality of LC elements, such as LC elements 1, 3, 5 and 7. The LC elements may be arranged in rows, such as rows 9 and 10, and columns, such as columns 13 and 13.

Each LC element may include liquid crystal material, such as material 25, 27, 29 and 31, sandwiched between a set of plates, such as plates 33, 35, 37, 39, 41, 43, 45 and 47, respectively. The amount of light that each element passes is a function of the voltage that is placed across the plates surrounding the liquid crystal material.

A system of driving lines, also often arranged in rows and columns, may be used to control these voltages and thus the light that each LC element passes. To set the voltage across the plates 33 and 35, for example, the row line 65 may be activated by a signal to the driver 81, thus closing the switch 49. The desired voltage may then be delivered to the column driver 85, thus placing it on the column line 73, into the closed switch 49, and ultimately across the plates 33 and 35.

This process may then be repeated to charge the other LC elements to the desired level.

Significant energy can be dissipated as each line is driven thorough the various voltage levels. Capacitance imposed by the driving line (e.g., line 73) can significantly contribute to this dissipation.

A first source of this capacitance is the LC element that is being charged (e.g., element 1) through a closed switch (e.g., switch 49) connected to the line (e.g., line 73).

A second source of this capacitance is the other switches (e.g., switch 5) that are connected to the line (e.g., line 73). These are often open while another element (e.g., element 1) is being charged. Yet, they can still load the line (e.g., line 73) with capacitance because of the inherent capacitance of the gates of electronic switches.

A third source of this capacitance is the proximity of each line (e.g., 73) to the backplane of the LCD.

A fourth source of this capacitance may be other sources, including stray capacitances.

The second through fourth sources just noted above are what have been referred to in this application as "other capacitances." To make this crystal clear, and pursuant to the Examiner's suggestion, the application has now been amended to specifically recite:

> "The sources of capacitance that are imposed on a driving line, other than the capacitance imposed by the LC element that is being driven, is referred to in this application as 'other capacitances.'"

During the charging of an LC element (e.g., element 1), the "other capacitances" must also necessarily be charged, as they are in parallel to the capacitance imposed by the plates of the LC element that is being charged (e.g., plates 33 and 35). This necessarily requires additional energy.

The invention includes approaches for both minimizing the amount of charging energy that is needed and conserving the energy that is used. The conserving aspect is perhaps the most germane to the outstanding office action. An example of this aspect will now be set forth.

As a first step, the row line 65 may be activated. This closes its associated row switches, including switch 49.

The desired voltage may then be delivered into the column driver 85, thus placing it on the column line 73, into the closed switch 49, and ultimately across the plates 33 and 35.

Energy then flows into the LC element 1 from the column line 73. Energy also flows into the "other capacitances" associated with the column line 73. Indeed, these "other capacitances" often exceed the capacitance of the LC element that is being charged by several times, requiring large amounts of energy to be delivered to them.

After the LC element 1 is charged to its full desired voltage (along with the "other capacitances"), the row line 65 may be deactivated, thus opening switch 49. The energy that is stored in the "other capacitances" that are associated with the row line 65 may then be transferred to a energy reservoir (e.g., 117) for later reuse.

This energy recovery may be effectuated by connecting the driving line 73 to the reservoir 117. Because the LC element 1 is no longer connected to the column line 73, however, the energy that was delivered to the LC element 1 *remains* in the LC element 1 during this process. The energy stored in the reservoir 117 may later be reused during the process of charging another LC element or even during the process of changing the voltage on LC element 1.

The Quoted Claim Elements Are Shown in the Drawings; Enabled by the Specification and Are Definite

With this background information in mind – all of which appears in the Specification – it should now be clear that each claim phrase quoted by the Examiner is shown in the drawings, is enabled by the specification, and is sufficiently definite.

The "liquid crystal elements" recited in Claims 1 and 13 are shown in Fig. 1 as elements 1, 3, 5 and 7 and are so described in the Specification at several places. This includes an introduction to the "liquid crystal (LC) elements" on page 1 in the first paragraph below the "Description of Related Art" section and a more detailed description on page 6 in the second and third paragraphs under the "Detail Description of Preferred Embodiments."

The "other capacitances" recited in Claims 1 and 13 have now been explicitly defined in the Specification, as suggested by the Examiner and as noted above. By virtue of this Amendment, the Specification now states:

> "The sources of capacitance that are imposed on a driving line, other than the capacitance imposed by the LC element that is being driven, is referred to in this application as 'other capacitances.'"

This definition merely brings together in one location the very descriptions that were present in the original application. *See* p.2, line 21 – p.3, line 18; p. 8, lines 8-19 (including phrase "other large capacitances"); p. 9, lines 10-11 ("As explained above, there are capacitances associated with column lines, other than the capacitance imposed by the LC element being driven . . . ."); p. 10, lines 17-25. The skilled artisan would also recognize the "other capacitances" as being intrinsic to the switches 49, 51, 53 and 45 and the driving lines 65, 67, 73 79 that are shown in Fig. 1. The "other capacitances" are also shown explicitly as part of the capacitor 105 in Fig. 2, the capacitor 133 in Fig. 5, the capacitor 231 in Fig. 6, and the capacitor 251 in Fig. 7.

The phrase "one or more of the other capacitances" and the similar phrases "a/one portion of the other capacitances" and "one or more other capacitances" in

Claims 1, 13, 54 and/or 58 merely indicate that a particular system may not have all of the types of "other capacitances" that are embraced by the definition of the phrase "other capacitances."

The phrase "a first one of the capacitive elements" in Claims 1 and 13 is not a reference to any of the "other capacitances" (i.e., the second through fourth items of capacitance discussed above in the "Technology Overview" section of these remarks), but rather is a reference to one of the "capacitive element[s] associated with the liquid crystal element" that is defined in the preamble of these claims (i.e, the first item of capacitance discussed above in the "Technology Overview" section of these remarks). To be sure, an example of "a first one of the capacitive elements" is illustrated in Fig. 1 and described in the specification as the capacitor formed by the plates 33 and 35 and intervening liquid crystal material 27.

The phrase "a current through the line associated with the first one of the capacitive elements" refers to the current that is delivered to the liquid crystal element through a line, such as the liquid crystal element 1 and its associated column line 73 shown in Fig. 1. The skilled artisan would readily recognize the presence of such a current from Fig. 1. Further, V_L in Fig. 5, Fig 8, and V_L in Fig. 14 illustrate example traces of the voltage that might be applied to the line, again clearly communicating to the skilled artisan the current that might flow.

The phrase "recovering energy from the portion of . . . without at the same time . . . of the first capacitive elements" in Claims 1 and 13 refers to the energy conservation aspect of one embodiment of the invention, as explained above in the "Technology Overview" section of these remarks. As discussed in this section and similarly in the patent Specification, the LC element that has been charged must be disconnected from its driving line after it is charged. The energy that was required to charge the "other capacitances" that were associated with the driving line may then be removed and stored in an energy reservoir. Because the "first capacitive element" has been disconnected from the driving line during this recovery, the claim correctly refers to the process as one that takes place "without at the same time recovering energy stored

in the first one of the capacitive elements." This allows the charge to remain on the charged LC element during the recovery process. To be sure, this process is clearly described in the Specification. *See* p.9, line 23 – p.10, line 9; p. 14, lines 3-25; and p. 21, lines 18-30; p. 22, lines 1-3. It is also illustrated in Fig. 3, in the traces in Fig. 5, particularly the trace for V_{ctl1}; and in the traces in Fig. 14, particularly line segments 733 and 735.

The phrase "the capacitive elements that are associated with the liquid crystal elements that are in the same row . . . the first one of the capacitive elements" in Claim 13 is a reference to the capacitive elements that are in the same row as the liquid crystal element that has been charged. An example of "the first one of the capacitive elements" are the plates 33 and 35 in Fig. 1. An example of "the capacitive elements that are associated with" this element are the plates 37 and 38 in Fig. 1. Claim 13 recites that the energy is recovered from the driving line (e.g., line 73 in Fig. 1) that charges the "first one of the capacitive elements" (e.g., plates 33 and 35 in Fig. 1) without at the same time recovering energy stored in the "first one of the capacitive elements" (e.g., plates 33 and 35 in Fig. 1) or from "the capacitive elements (e.g., the plates 37 and 39 in Fig. 1) that are associated . . . in the same row as . . . the first one of the capacitive elements."

The phrase "the first time period" in Claim 25 refers to the time period during which the voltage source is connected to the line (typically the charging period). This period is shown by step 102 in Fig. 3, by segment 213 of the trace in Fig. 5, and by the V_{CTL1} pulse in Fig. 5.

The phrase "the second time period" in Claim 25 refers to the time period during which the reservoir is connected to the line (typically the energy recovery period). This period is shown by step 113 in Fig. 3, by segments 283 and 289 in Fig. 5, and by the V_{CTL2} pulse in Fig. 5.

The phrase "the plurality of pixels of a display" in Claim 54 is a generic reference to "picture elements," also known as "pixels." Examples of these are shown in Fig. 1 as LC elements 1, 3, 5 and 7.

The phrase "the charge stored in one of the plurality of pixels of a display" in Claim 54 is a reference to the charge stored in a picture element. As indicated above, examples of picture elements are shown in Fig. 1 as elements 1, 3, 5 and 7. An example of the charge that may be stored in one of these elements is represented as the segment 361 in V_L in Fig. 5.

The phrase "a plurality of liquid crystal elements arranged in a matrix of rows and columns" in Claim 58 is a reference to the "liquid crystal elements" discussed above in connection with Claim 1. Examples of these are shown in Fig. 1 as elements 1, 3, 5 and 7, arranged in rows and columns.

The phrase "the line also driving one or more other capacitances" in Claim 58 is a reference to the "one or more other capacitances" discussed above in reference to Claim 1. The reference to "the line also driving" these capacitances is a reference to the "other capacitances" being driven by a line. An example of such a line is shown in Fig. 1 as column line 73.

The phrase "a storage device" in Claim 58 is a reference to the storage device that stores the voltage of the video signal used to drive the capacitive elements. Examples of such devices are shown in Fig. 2 as the voltage source 111, in Fig. 6 as V_1-V_N, in Fig. 7 as C_T (items 262 and 263), and in Fig. 9 as supply 301.

The phrase "a first voltage regulator" in Claim 58 is a reference to a voltage regulator that may be used to regulate the voltage that is delivered by the voltage source. An example of such a regulator is shown in Fig. 4 as including switching device 147 and discussed in the associated portion of the Specification. *See* page 12, lines 16-18.

Non-Patent References Cited

The Examiner has not indicated that he has considered the non-patent references, originally filed February 25, 2000, and re-filed with Applicant's amendment on January 13, 2003, nor the duplicate copy of the additional reference filed in the Information Disclosure Statement, filed January 13, 2003. Applicant therefore encloses

the Form PTO-1449 for both of these previously-filed Information Disclosure Statements, along with a still further copy of the non-patent references cited therein. Applicant respectfully requests that the Examiner indicate on the Form PTO-1449 that he has considered these references.

Conclusion

It is believed that the amendments that applicant has made, coupled with these remarks, have now placed this case in condition for allowance and early notice of the same is earnestly requested.

The Commissioner is authorized to charge Deposit Account No. 501946 for payment of any additional fees required by this response or to credit any overpayment to the account. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

September ____, 2003

Marc E. Brown, Attorney for Applicant
Registration No. 28,590

McDermott, Will & Emery
2049 Century Park East, 34th Floor
Los Angeles, California 90067
Telephone: (310) 788-1569
Facsimile: (310) 277-4730